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Performance comparison between scintillating polymer optical fibers and a Si-Pin detector for radon monitoring

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Radon monitoring usually relies on the detection of the radiation emitted by its progeny nuclides. Detectors are optimized for one type of radiation, the most common being either gamma or alpha radiation. Scintillation detectors have been used with success for gamma radiation while semiconductor detectors are preferred for alpha radiation. Plastic scintillating optical fibers might be an alternative to these detectors. They are sensitive to the three types of radiation (alpha, beta, gamma) emitted by radon and its progeny and can be obtained in a variety of lengths and diameters.

In this work the use of plastic scintillating optical fibers was exploited for radon monitoring, comparing their detection performance to a Si-PIN detector. The scintillating optical fibers used were three multi-clad BCF-60 fibers with a diameter of 4 mm and 50 mm length directly coupled to a Hamamatsu photomultiplier R647-01. The Si-PIN detector used was a S3590-08 from Hamamatsu with an active area of 100 mm^2. Each setup was connected to a multichannel analyzer used for energy discrimination. The tests were performed using an enhanced confined mode set-up consisting of a container filled with rocks rich in uranium oxides. A metal hose carries the radon gas from the generator container to a T-junction pipe that distributes the gas to the detectors. Simultaneous acquisition by the scintillator detector and the Si-PIN detector is thus obtained. A good correlation was observed between the response of the scintillator and the Si-PIN detector.